QUALITY AND GRADE OF TANOAK TIMBER ON THE HOOPA VALLEY INDIAN RESERVATION IN CALIFORNIA

Northeastern Forest Experiment Station, Upper Darby, Pa.
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A Report to the Economic Development Administration

U. S. Department of Commerce[1/]

Introduction

Since Humboldt County, California, has been declared an economically depressed area and the Hoopa Valley Indian Reservation a special "poverty pocket" entirely within this county, the Economic Development Administration has been searching for ways to attract additional industry into the area. Therefore, at the request of Mr. Norman G. Baker[2/] to the Forest Service, Mr. Roswell D. Carpenter and Everette D. Rast were contracted to carry out a stem analysis showing tree quality and log grade of tanoak (Lithocarpus densiflorus) on the Hoopa Valley Indian Reservation, California and to train the Bureau of Indian Affairs Forestry Staff at Hoopa in log and tree grading, and bucking and sawing for grade. This work was a part of a feasibility study to determine if the area had sufficient quantity and quality of tanoak to justify setting up a hardwood manufacturing complex in the form of a tribal-owned enterprise.

The study ran from September 8 through September 19, 1969, with the major emphasis placed on tanoak. Tree-log data was taken for 275 tanoak trees, 16 Pacific madrone, and 4 golden chinkapin.

Prior to the start of the field study one day of classroom instruction was given to the B.I.A. Forestry Staff in log and tree grading. The classroom instruction closed with a slide illustrated presentation covering the best practices for bucking trees into logs and also for sawing the logs to obtain the highest yield of the upper grades of factory lumber.

Due to the fact that there was no mill sawing tanoak logs at that time within reasonable traveling distance, a second full day was spent on instruction in the woods. In order to acquaint the trainees with the quality characteristics which could be expected under the existing exterior indicators of defect, a few certain carefully selected trees were felled and dissected with a chain saw in order to replace the work which would have been done at the sawmill. It is felt that this work did more than partially provide the results which we had hoped to gain from work at the sawmill.

1/ Report prepared by USDA, Forest Service, Northeastern Forest Experiment Station, Project 3102, Quality and Grade of Hardwood Timber, Columbus, Ohio. Roswell D. Carpenter and Everette D. Rast, Forest Products Technologists.

2/ Project Officer, Office of Technical Assistance, Economic Development Administration, U.S. Department of Commerce.

On the third day the actual selection of the trees and the tree log grading of each was commenced. This work continued through September 19 or for a period of 8 days. With a few exceptions for some individuals, the entire B.I.A. Forestry Staff participated in the tree grading phase without interruption. This feature enabled the instructors to ascertain that all the trainees had satisfactorily absorbed the basic principles of hardwood log grading and the principles of applying log grades to the stem of a standing tree. This method will have to suffice for determining the quality of a tanoak tree until such time as tree grade specifications and regression equations can be developed for prediction of the quality and value of tanoak trees.

Field Procedure

The main areas to be sampled in our tree selection had been laid out by the B.I.A. Forestry Staff. During the first day of the tree selection the B.I.A. Forestry Staff was given intensive training in tree log grading, identification of defect indicators, and cull estimation in hardwoods. Except for occasional instances the majority of the B.I.A. Forestry Staff was present during the entire tree selection and grading.

The goal in the tree selection was to get 10 trees in each cell, that is for each 1" diameter class and tree log grade. The DBH of the sample trees was measured to the nearest tenth-inch with a diameter tape on the high side of the tree. Merchantable height was measured to the nearest one-half log with an Abney Level. Girard form class was estimated for each tree. Estimates of sweep, crook, rot, and fire scare were made to determine the volume of scalable defect.

The logs were graded in the standing tree using the Forest Service Standard Hardwood Log Grades for Factory Lumber. Also Construction and Local Use Class Logs were classified according to Forest Service specifications (6). The logs were graded as 16-foot logs to conform to volume table measurements. However, the grade of the best 12-section was used to determine the grade of the full 16' log if it resulted in improving the log grade. This method has been used by the Eastern Forest Survey for many years.

The areas of selection and the number of tanoak trees from each is as follows:

Bald Hill Road -	121
100 Acre Prairie Rd.-	97
Pine Creek -	51
Mill Creek -	6

At the time of tree selection, each tree chosen was spray painted with a number. The 275 trees were numbered consecutively from tree one on the Bald Hill area through tree 275 on the Mill Creek area. This was done with two purposes in mind. The B.I.A. Foresters were supplied with a set of tree scale sheets containing the original data so that they could use the trees for further study and self-checking or to instruct B.I.A. Foresters in hardwood tree log grading from locations other than the Hoopa Valley Indian Reservation. Secondly, in the event that it should be decided to conduct a mill scale study to provide lumber grade yield data for tanoak, the mill scale study sample trees could be selected from the tree log grade scale sheets resulting in a substantial saving in both time and money.

Potential Lumber Grade Yields For Tanoak

The 275 study trees yielded 975 grade logs with a net volume of 242,041 Bd. Ft. International 1/4" Scale and 238,759 Bd. Ft. Scribner Scale as shown in Tables 4, 5, and 6. Tree diameters ranged from 12 through 54 inches with 61% of the trees falling in the diameter classes between 21 and 35 inches. Tree heights ranged from 1 log through 7 logs with 76% falling into the 2, 2½, 3, 3½, and 4 log heights, as shown in tables 2 and 3. Table 1 shows the tree butt log grade by log height. It should be noted that the butt logs for 230 of the 275 trees fell into log grades 1 and 2. While tallying these we were able to find only 45 merchantable trees with a butt log grade as low as grade 3.

The major percentage of the tree volume was contained in trees ranging in diameter from 21 inches to 39 inches as shown in tables 4, 5, and 6. It is notable that 91% of the total tree volume fell in trees between 2 and 5 logs in height. The volume in 4 log trees was more than twice that contained in any other two tree heights added together. Table 6 shows that 383 or 39% of the 975 logs fall in grades 1 and 2, whereas 51% of the log volume falls in these upper grades.

An inventory of Humboldt County in the Summer of 1966 by Forest Survey (7) shows that of 939 million Bd. Ft. of tanoak trees, 485 million Bd. Ft. were in trees of 20 inches and up DBH. This strongly supports what we found on the Hoopa Valley Indian Reservation during our tree selection for the study.

The only lumber grade yield data which is available for tanoak is that from a study conducted by the University of California Forest Products Laboratory and reported in February 1965 (1). A careful analysis of the report of this study strongly indicated that there was a substantial number

of misplaced logs. Another weakness of the study is the fact that only 93 logs were sawn. These ranged in scaling diameter from 12 through 34 inches. The sawing study sample showed 61% of grade 1 and 2 logs, whereas the tree study sample showed but 39%. We believe that the tree study sample more nearly represents the true distribution of the log sizes and grades for the total tanoak tree population than does the sawing study sample. Another difference between the two studies is that of log size by log grade. The sawing study shows average log diameters of 25.0", 21.0" and, 19.2" for log grades 1, 2, and 3, whereas the tree study shows 24", 20", and 17" respectively. Log diameter is the most important factor affecting log grades in hardwoods, and in any system of log grading scaling diameter is always listed as the first specification.

A universally accepted measure of a hardwood log's potential to produce factory grade lumber is its yield of the #1 Common and Better grades of lumber (10). The grade 1 logs included in the sawing study yielded 65% of #1 Common and Better. Our best estimate of the production of #1 Common and Better from the Grade 1 logs included in the tree study falls somewhere between 66% and 70%. The yields of the upper grades of lumber in both cases are in reasonable agreement. However, the yields of #1 Common and Better lumber for log grades 2 and 3 are substantially apart. The grade 2 logs in the sawing study show a yield of 52% of #1 Common and Better lumber. We believe that this is too high and that the reason for the over-prediction is the larger average diameter of the logs. Our estimate of the yield of #1 Common and Better lumber from the tree study logs is very close to 46% - a difference of 6%. Further the grade 3 logs from the sawing study showed a yield of 43% of #1 Common and Better lumber. The grade 3 logs from the tree study would yield very close to 31% of these upper grades of lumber - a difference of 12%. This large difference can be accounted for by two causes. The first and most important of these causes is the larger average scaling diameter of the grade 3 logs in the sawing study. The second cause is the wrong placement of a number of logs in this grade. However, this number cannot be accurately determined.

Conclusions and Recommendations

Referring to the All Logs Section of Table 6, several reliable conclusions become apparent. First, the 22% of the log volume in grade 1 logs is going to yield about 67% of #1 Common and Better lumber. The 29% of volume in grade 2 logs will yield 46% of the same grades of lumber, and the 48% of log volume in grade 3 logs will yield about 31% of these same grades of lumber. Additional calculations demonstrated that the average yield for all grades of tanoak logs should be 43% of #1 Common and Better lumber.

Of the 43% of #1 Common and Better lumber expectable from all tanoak, 25% should grade Firsts and Seconds, 11% Selects, and 64% #1 Common when graded according to the Standards of the National Hardwood Lumber Association. The remaining 57% of #2 and #3 Common lumber should be satisfactory for a number of products, including some furniture dimension, flooring, railway ties, dimension timbers, and various items of railway car material. These product considerations may indicate the desirability of running a mill scale study as soon as the plant is past the shake-down phase of operation in the event that the decision is made to construct a manufacturing plant.

In light of the foregoing conclusion, it can be recommended that a sawmill and product manufacturing plant using tanoak as the principal species can be built to operate profitably if sufficient volume of timber is available to sustain the operation at a level of at least 4 million board feet per year. If, on the other hand a decision is made to sell timber from the reservation, then all timber should be appraised and sold by log grade in order to insure the best return to stumpage.

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Table 1

Butt Log Grade By Tree Height

For 275 Tanoak Trees

Hoopa Valley Indian Reservation, California

Butt Log Grade	1	1½	2	2½	3	3½	4	4½	5	5½	6	7	Total
1			6	2	23	9	44	6	14	3	3	1	111
2	1	3	16	10	31	15	25	6	10	1	1		119
3	4	9	11	6	5	3	4	3					45
Totals	5	12	33	18	59	27	73	15	24	4	4	1	275

Table 2

Butt Log Grade By Tree DBH

For 275 Tanoak Trees

DBH	1	2	3	Total	DBH	1	2	3	Total
12			1	1	30	6	4		10
13			4	4	31	6	5		11
14		6	3	9	32	2	3		5
15		6	4	10	33	5	3		8
16		6	4	10	34	4	2	4	10
17	1	4	2	7	35	3	2	1	6
18	4	5	2	11	36	5	1		6
19	1	5	3	9	37	3	1		4
20	7	1	3	11	38	4	1		5
21	5	8	2	15	39	1	4		5
22	5	10	1	16	40	1			1
23	7	5	1	13	42	1			1
24	7	8		15	43	1	1		2
25	8	8	3	19	44	1			1
26	2	6		8	45	1			1
27	7	3	3	13	48	1			1
28	6	8	1	15	52			1	1
29	5	3	2	10	54	1			1
Totals						111	119	45	275

Table 3

All Trees

By DBH + Log Height

DBH	1	1½	2	2½	3	3½	4	4½	5	5½	6	7	Total
12		1											1
13	2	1		1									4
14	3	2	2	1	1								9
15		2	4	1	2	1							10
16		1	6		2		1						10
17			4		3								7
18			4	2	3		1	1					11
19		1		2	4		1		1				9
20		2	1		3		4		1				11
21			1	4	6	1	3						15
22			2	1	4	2	6	1					16
23			1	1	4	1	5		1				13
24				1	5	2	5	1	1				15
25			1		4	3	4	3	4				19
26					1	4	3						8
27				2	2	3	5	1					13
28				1	4	2	4		2	2			15
29		1	1			3	4	1					10
30					1	1	5	2			1		10
31			1	1			5		3	1			11
32						1	2		1		1		5
33					2		2		4				8
34		1	2		3		2		1	1			10
35			1			1	1	1	1		1		6
36					2		2		2				6
37							3	1					4
38					1		2	1			1		5
39			1		1			1	2				5
40												1	1
42							1						1
43						1	1						2
44						1							1
45			1										1
48							1						1
52								1					1
54					1								1
Totals	5	12	33	18	59	27	73	15	24	4	4	1	275

Table 4

All Trees

Net Volume By DBH + Log Height

(Bd. Ft. Int. 1/4-inch)

DBH	1	1½	2	2½	3	3½	4	4½	5	5½	6	7	Total
12		68											68
13	94	82		135									311
14	237	184	254	150	172								997
15		203	550	160	415	225							1553
16		114	1013		421		271						1819
17			644		841								1485
18			882	507	787		359	408					2943
19		184		581	1395		440		507				3107
20		486	247		1051		1781		580				4145
21			269	1474	2493	495	1441						6172
22			696	411	1920	1033	3633	666					8359
23			250	478	1987	588	3246		666				7215
24				448	2891	1324	3478	742	806				9689
25			417		2364	1944	3202	2591	3704				14222
26					728	3176	2595						6499
27				1234	1576	2515	4455	1076					10856
28				673	3230	1938	4291		2611	2372			15115
29		551	615			3059	4767	1249					10241
30					943	1230	6031	2402			1662		12268
31			745	771			6364		4637	1784			14301
32						1346	2805		1717		2199		8067
33					2493		3111		7087				12691
34		792	1818		3620		3066		1893	2111			13300
35			747			1312	1896	2059	1939		2313		10266
36					2075		3692		4344				10111
37							6151	2069					8220
38					1670		4217	2368			3091		11346
39			886		1640			2367	5361				10254
40												3709	3709
42							1917						1917
43						2568	2148						4716
44						2564							2564
45			1566										1566
48							4340						4340
52								4104					4104
54					3505								3505
Total	331	2664	11599	7022	38217	25317	79697	22101	35852	6267	9265	3709	242041

Table 5

All Trees

Net Volume By DBH + Log Height

(Bd. Ft. Scribner)

Log Heights in 16' Logs

DBH (In.)	1	1½	2	2½	3	3½	4	4½	5	5½	6	7	Total
12		66											66
13	91	79		131									301
14	230	178	246	145	167								966
15		197	535	156	404	219							1511
16		111	987		410		264						1772
17			629		821								1450
18			863	496	770		351	399					2879
19		180		569	1367		431		497				3044
20		477	242		1031		1748		569				4067
21			264	1448	2449	486	1403						6050
22			684	404	1888	1016	3572	655					8219
23			246	470	1955	578	3193		655				7097
24				441	2846	1303	3423	730	793				9536
25			411		2329	1915	3155	2553	3650				14013
26					718	3132	2559						6409
27				1218	1555	2482	4396	1062					10713
28				664	3189	1913	4236		2578	2342			14922
29		544	607			3021	4708	1234					10114
30					932	1215	5959	2346			1642		12094
31			736	762			6288		4582	1763			14131
32						1330	2772		1697		2173		7972
33					2465		3076		7006				12547
34		783	1798		3581		3033		1872	2088			13155
35			739			1298	1876	2038	1919		2289		10159
36					1977		3655		4301				9933
37							6090	2049					8139
38					1653		4175	2345			3060		11233
39			877		1624			2344	5308				10153
40												3672	3672
42							1825						1825
43						2545	2129						4674
44						2541							2541
45			1552										1552
48							4301						4301
52								4072					4072
54					3477								3477
Total	321	2615	11416	6904	37608	24994	78618	21827	35427	6193	9164	3672	238759

Table 6

Number Of Logs And Net Volume

By Log Grade And Position

For All Trees

Grade	No.	%	Net Volume Bd. Ft. Int. 1/4"	Scrib.	% Scrib.
			Butt Log		
1	111	40	42797	42283	52
2	119	43	31053	30618	37
3	45	17	9185	9056	11
Totals	275	100	83035	81957	100
			2nd Log		
1	21	8	9226	9115	14
2	84	31	24644	24299	37
3	162	60	32824	32364	49
S	3	1	318	314	--
Totals	270	100	67012	66092	100
			3rd Log		
1	3	1	1160	1146	2
2	34	15	11293	11135	22
3	180	81	37962	37431	74
S	5	2	1023	1009	2
LU	1	1	102	101	--
Totals	223	100	51540	50822	100
			4th Log		
2	9	6	2671	2634	10
3	135	92	24752	24405	88
S	2	1	293	289	1
LU	1	1	313	309	1
Totals	147	100	28029	27637	100
			5th Log		
2	2	4	727	717	7
3	48	96	9308	9178	93
Totals	50	100	10035	9895	100
			6th Log		
3	9	100	1980	1952	100
			7th Log		
3	1	100	410	404	100

(Cont'd)

Table 6

Number Of Logs And Net Volume

By Log Grade And Position

For All Trees

Grade	No.	%	Net Volume Bd. Ft. Int. 1/4"	Scrib.	% Scrib.
			All Logs		
1	135	14	53183	52544	22
2	248	25	70388	69403	29
3	580	59	116421	114790	48
S	10	1	1634	1612	1
LU	2	1	415	410	-
Totals	975	100	242041	238759	100